THE UNDER SECRETARY OF DEFENSE
WASHINGTON, DC 20301

ACQUISITION

20 MAY 1992

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN, JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE (POLICY)
DIRECTOR, DEFENSE RESEARCH AND ENGINEERING
ASSISTANT SECRETARIES OF DEFENSE
COMPTROLLER
GENERAL COUNSEL
DIRECTOR, OPERATIONAL TEST AND EVALUATION
ASSISTANTS TO THE SECRETARY OF DEFENSE
DIRECTOR, ADMINISTRATION AND MANAGEMENT
DIRECTORS, DEFENSE AGENCIES

SUBJECT: Defense Acquisition

The Department of Defense (DoD) has revised its approach to acquisition in response to dramatic changes in the national security environment. Four white papers that elaborate on different aspects of our acquisition strategy and policies are attached.

The revised approach calls for increased investment in Science and Technology (S&T) as well as better focus and integration of S&T oversight. DoD's revised approach will help ensure that a variety of technologies are pursued until they are fully matured and ready for application to systems development efforts. The transition point from the demonstration of technology in one or more S&T projects to a formal acquisition program for a new system occurs at Milestone I when a program begins the demonstration and validation phase. This occurs after a validated need has been approved at Milestone 0 and the technologies critical to system performance have been proven. We will accept less risk in acquisition programs than we have in the past. DoD will continue to follow the full funding guidance issued by the Deputy Secretary in July 1991 for all programs already in or reaching the acquisition stage.

Although the most immediate impact of the revised approach was on the ten major acquisition programs adjusted in the FY 1993 Amended President's Budget, all programs will be managed in accordance with this approach. The Secretaries of the Military Departments should review existing acquisition programs to determine which programs should be restructured to reflect the revised approach, if they have not already done so.

Don Yockey

Attachments

340

## DEFENSE ACQUISITION

The dramatic lessening during the last three years in the threat of a large-scale, fast-reaction land war in Europe permits the United States to significantly reduce the size of its armed forces. This reduction is underway and will continue for several years until a base force structure is attained which is approximately twenty-five (25) percent smaller than the current land, sea, and air forces. It will still be the strongest military force in the world, but it will be smaller.

In addition, with the breakup of the Warsaw Pact and the dissolution of the Soviet Union, the pressure of rapidly advancing high technology weapons in the arsenals of potential enemies has also significantly lessened. Consequently, the need to replace existing weapons systems in order to maintain a significant technological advantage is no longer as urgent. As a result, we will be able to reduce concurrency in development programs and retain existing equipment for longer periods, with necessary technological advances incorporated more often through upgrades than through initiation of new systems.

The reduced urgency for modernization, coupled with the smaller armed forces, means that the Department will acquire fewer weapons systems and that the acquisition budget will be reduced accordingly. These reductions will have significant implications for the defense industry and will, in many cases, result in excess production capacity. For those weapons programs already being cancelled or curtailed, there is still sufficient direct or related production remaining that critical manufacturing capabilities will not be lost while we conduct assessments to assure the long-term viability of the essential elements of the defense industrial base.

The Department still expects to spend a significant amount of funds on procurement in the years ahead. This level of spending will in most cases result in continuity of production. Nevertheless, because the current inventory of some

weapons is large enough to meet our needs for a long while, reducing production of these could lead to gaps in capability. As a consequence, it is imperative that critical manufacturing processes which would be difficult to reconstitute or restart at a later date be maintained. The Under Secretary of Defense for Acquisition (USD(A)) has tasked the Assistant Secretary for Production and Logistics (ASD (P&L)) to develop a plan for identifying such critical manufacturing processes and to identify options for sustaining them during a production gap.

Although we will reduce the quantity of new weapons produced, the need to maintain technological superiority, a key combat force multiplier, will drive us to increase efforts in developing new and innovative technology. There are seven areas in the expanded science and technology program which will provide a focus for development of new and promising ideas, including those related to manufacturing processes. Additional funding allocated to these seven areas will provide the opportunity for the best of these ideas to be proven in Advanced Technology Demonstrations (ATDs). These ATDs will be focused on validating the maturity and utility of advanced technologies and will, thereby, reduce performance, cost, and schedule risks in future acquisition programs. The USD(A) has tasked the Director of Defense Research and Engineering (DDR&E) to define the details, including the management process, for the expanded science and technology program. This S&T management oversight process is summarized in a companion paper.

Although new procedures are being developed by the DDR&E to manage a newly robust science and technology program, the procedures as recently revised and as defined in DoD Directive 5000.1 and Instruction 5000.2 will still be used to manage the overall acquisition system. Many ATDs will not progress to either an upgrade or to a new weapon system. Those that do progress will fall under the existing procedures whereby the transition from a science and technology program to a formal acquisition program occurs at Milestone I for new systems. This is the point by which the technologies critical to system performance should be proven. The funding guidance issued by the Deputy Secretary in July 1991 applies to all programs reaching the acquisition stage: full funding for the Future Years Defense Program is required from this point on in order to assure the fiscal soundness and stability of each program.

The key distinction between ATDs and acquisition system activities is that the former are part of the science and technology base and are focused on validating the viability and producibility of a technology. The acquisition system activities, on the other hand, are undertaken only when the following criteria are met:

1. The technologies have been demonstrated, thoroughly tested, and shown to be producible.

2. There is a clear and verified military need for the new system or system upgrade.

3. The new system or system upgrade is cost effective.

Systems that meet these criteria will enter the acquisition cycle and, in addition to supporting our base force, will engage the defense industrial base in modern production activities.

The department has four main objectives for this defense industrial base:

1. It must support the base force structure in peacetime.

2. Beyond peacetime, it must be capable of supporting planned needs during contingencies.

3. It must be able to provide production capacity capable of meeting the needs to combat an emerging global threat.

4. It must be efficient and cost effective.

To address these production base issues, to guide the science and technology initiative, and to integrate the acquisition system with these initiatives, the following actions are under way:

1. Preparation of a Defense Science and Technology Strategy the DDR&E for approval by the USD(A). This strategic view provides the mechanism for identifying promising technologies and existing critical technologies and is summarized in a companion paper.

2. Establishment of a Defense Technology Board, chaired by the Director, Defense Research and Engineering and with senior OSD, Joint Staff, and Service representation, to help ensure improved integration of science and technology with the system acquisition process.

3. Preparation by the ASD(P&L) for approval by the USD(A) of a plan which will define the steps to be taken to maintain an adequate defense industrial base. This initiative, which is described in more detail in a companion paper, will address key issues such as the identification of critical processes and skills, increased efficiency and competition, and investment in manufacturing process research and development.

4. Establishment of a senior level Defense Conversion Committee reporting to the Secretary and Deputy Secretary of Defense. This committee will serve to define the economic and labor difficulties faced by shrinking portions of the defense industry and develop a strategy to address these concerns.

Change is inevitable -- it is happening already. The approach described in this paper is the best approach for the Defense Department to meet it's responsibilities under current and projected conditions. We will meet our obligations to support the base force structure with the quality and quantity of necessary weapons and supplies.

# Defense Industrial Base

## The Setting

U.S. national military strategy for nearly five decades focused on the threat imposed by the Soviet Union and its communist ideology. The most demanding military requirement was to be prepared for a quick thrust, major Soviet attack in Europe that could rapidly escalate into a global conflict. The United States and its allies would be forced to fight against massive Soviet forces equipped with the most modern weapon systems. To meet this threat, the United States had to field relatively large numbers of systems while pushing modernized weapons into production as quickly as possible.

With the demise of the Soviet threat, the need for development, production and fielding of a large number of modernized weapon systems and munitions has ended, as has the need to provide industrial capacity to surge the production of major weapon systems during a crisis.

Certain realities remain, however. There are still threats to our security, and the United States is still looked to for world leadership. We must be able to deal with future threats to U.S. interests in an uncertain and unstable world.

These future challenges can be met with a smaller force, as long as that force maintains the kind of technological edge demonstrated in Operation Desert Storm. Less equipment is required, and, in many cases, the service life of that equipment can be extended because the pressures for modernization and replacement have greatly diminished. Defense spending will continue to be reduced, with a shift in priority toward science and technology, including manufacturing process technology.

## The Changing Industrial Base

These changes have obviously affected, and will continue to affect, the industrial base. After a period of rapid growth in the early 1980's, the defense acquisition budget has been declining, with defense firms reacting accordingly. Companies and organic defense depots continue to downsize and streamline and divest excess capacity by sale, merger, or plant shutdown. Further changes are

likely. Prime contractors may decide to bring subcontracted work in-house, and some suppliers may leave the defense business. The result should be a smaller, more efficient industrial base -- one better sized to meet our reduced needs.

The Department has four principal objectives for the industrial base over the next ten to twenty years. First, and most importantly, it must support the base force structure in peacetime. Second, beyond peacetime, it must be capable of supporting planned contingency-related needs. Third, the industrial base must be able to build up production capacity faster than any newly emerging global threat can build up its capacity. Fourth, the industrial base must be as efficient and cost effective as possible.

Approach

The Department has formulated a four-step approach to meet these objectives:

(1) Continue to invest a significant amount of funds in procurement of cost effective, producible, and necessary systems (or system upgrades) to maintain the superiority of U.S. weapon systems.

(2) Continue to develop new and innovative manufacturing technologies to improve the efficiency of production.

(3) Establish an industrial base oversight process which will:

- Identify critical processes, products, or capabilities.
- Monitor changes occurring in the industrial base to obtain early warning of the potential loss of these critical items.
- Take actions to preserve a needed critical process, product, or capability in those exceptional situations where it may be lost and cannot be recovered in time to meet an emerging threat.

(4) Stimulate changes in the industrial base that will increase efficiency and competition.

The following sections address each of these steps.

Acquisition Investments

Generally speaking, the industrial base will not reach a new equilibrium overnight, nor will the transformation be drastic. The Department continues to invest a sizeable amount of resources in research and development and weapon systems procurement. Under current plans, between Fiscal Year 1993 and Fiscal Year 1997, we will spend nearly $190 billion in research and development. This represents about 14 percent of the defense budget. Projected procurement expenditures for the same period total over $300 billion, or about $60 billion per year -- 22 percent of the DoD budget. Therefore, there is no reason to believe that continuation of the current competitive acquisition practices will cause either the technology base or the major defense prime contractor and subcontractor production base to reach dangerously low levels. Accordingly, the primary Department approach to the downsizing will be to continue to let the free market prevail through competition. It is expected that some exceptions to this approach may be necessary. The process for handling exceptions is described later.

Investment in New Manufacturing Methods

DoD is pursuing a specific thrust area within the Science and Technology Program entitled Technology for Affordability. This initiative examines new technologies for time, cost, and production efficiencies in the areas of hardware/software prototyping, flexible production capabilities, and advanced manufacturing processes. This process-oriented thrust supports the development of new product technologies within the Science and Technology strategy.

The Department is committed to expanded research and development to make manufacturing processes more flexible. Flexible manufacturing processes can be adapted to produce more than one type of item. This makes the production of a smaller number of each type of item more efficient, which will reduce reliance on economies of scale. It also has the potential to provide entirely new manufacturing methods which could replace existing critical processes.

The Department also will continue to make design and manufacturing processes more efficient by investing in modernization. An example is Computer-Aided Acquisition and Logistics Support (CALS). CALS serves as the framework for a joint

DoD/Department of Commerce/industry initiative for standardizing product design data in digital form. This data standard will enable designs to be produced in a common computer format so that it can replicated easily anywhere in the acquisition cycle for design improvements, manufacturing work instructions, or maintenance. This concept facilitates rapid prototyping, production efficiency, and production restart/reconstitution.

The Industrial Base Oversight Process

The Department oversees the industrial base in order to ensure that critical manufacturing processes are maintained, even during gaps in production. We know that some critical production elements would be difficult to reconstitute. Thus, support may be needed to maintain their timely availability. Such manufacturing capabilities, including not only technologies but also critical engineering and unique worker skills as well, must be protected.

However, where technology or a manufacturing process is not critical for reconstitution purposes, it will not be funded. We cannot support non-critical elements of industry just to keep them going.

The Department divides the industrial base into six major sectors: aircraft, ships, combat vehicles, missiles and space, munitions, and electronics. The oversight process starts with the identification of critical industrial processes, products, and capabilities. The industrial base is then monitored to provide early warning that a critical process, product, or capability may be lost. The Department takes action if the situation requires an extraordinary measure.

Identification of Criticality

Identifying critical processes, products, and capabilities is a complex and multifaceted endeavor. The Department applies a three-step approach to address this problem, and the approach is similar whether it is a product, process, or a capability in question. For simplicity, they will be referred to as "items."

The first step is to screen the item. The goal of item screening is to identify potential candidate items for further analysis in a prioritized order. Items that are

obviously non-critical are eliminated at the start of the process. Remaining items are then put in order of priority for further consideration.

Major defense acquisition programs are examined as part of this process at each milestone. Items about to go out of production are also reviewed because they could become critical. Finally, out-of-production items are analyzed for criticality.

The second step is the determination of whether or not there is likely to be a critical shortfall for a particular item under consideration. A set of criteria is applied to determine whether the item is or will likely be needed to support reconstitution requirements or other future acquisition needs.

Once this requirement is established, the item's availability is determined. Availability includes on-hand inventory, including assets in long-term storage, and the amount of production that may be obtained from the industrial base. The potential to reconstitute production facilities is also considered. A shortfall exists if the item's availability does not meet the known requirement.

The third step in the process is to determine the nature of the shortfall, that is, whether the problem is with a process, technology, skill, material, equipment, or facility. Detailed analyses are routinely made as part of the acquisition process, the programing and budgeting process, or a special study. Once identified, the critical item moves to the next step in the process -- a determination of whether or not some special action by DoD is required.

Monitoring the Changes

A primary reason to proceed to the next step in the process is a significant decline in the business base for an industry. Therefore, the Department monitors defense spending for products and services by industry over time to provide an early warning that an industrial or technological capability essential to production might be in jeopardy.

Our basic plan has been to examine the industrial base in sufficient detail to understand and describe the relationships among industrial sectors. The Fiscal Year 1990 and 1991 Reports to Congress on the Industrial Base were written to provide that description. Our on-going analyses continue to pursue this effort.

The monitoring is carried out on an industry-by-industry basis for several hundred industries. If a significant decline in anticipated purchases is observed, the Department examines the industry in much more detail. Additional factors such as non-defense business, vulnerabilities specific to defense programs, foreign sales, the involvement of unique skills and trades, the need for specialized facilities and long-lead time industrial equipment, and the number and type of items involved are also considered. The focus is on the viability of minimum essential capabilities to provide a future, timely response, not the survival of any particular firm.

In general, this careful monitoring approach is working. There are very few candidates for extraordinary measures.

The Exceptions

In those few cases where it appears that an essential, unique capability may be lost in a way that will likely preclude timely reconstitution, the Department is taking action. Criteria for action are as follows:

- There are no other product or process solutions available now.

- The product or process solution available now will not be available when it may be needed in the future.

- There are no other solutions on the horizon.

The resources required to maintain a specific capability until it might be needed are weighed against the affordability, time, and other resources required to regenerate that capability in the future. Alternative sources or substitutes will be sought for the potential needed future capability.

If there are no substitutes or alternative sources, and if analysis shows that reconstitution would take too long or be too expensive, other options are examined to provide the needed capability. Options include related DoD contract work, opening additional maintenance and repair work to competition between the public and private sectors, related R&D efforts, or directed procurements. Continuation of actual production is not expected to be needed except in rare circumstances.

Nuclear propulsion technology is one area that has been identified as an essential, unique capability which will be difficult to maintain during a period in which there is a gap in the production of submarines. The Department is examining options to ensure that nuclear propulsion and other submarine technology capabilities will be available when needed.

Chemical agent antidote autoinjectors are an example where the Department has in the past and will in the future maintain a very limited production capability.

Tank production, on the other hand, is an example of a situation in which no action is required beyond research and development of armor. M1 Abrams tank production is about to end, and production of a new generation tank is not expected to begin until later in this decade or after the turn of the century. Realizing this, the Department used the methodology just described to perform a comprehensive industrial base analysis for tank production. This analysis addressed the implication of plant layaway, start-up, and ramp-up with regard to cost, lead-time, spares, major subcontractors and vendors, critical skills, and environmental conditions. The study identified the risks associated with varying production rates for electro-optics, engines, transmissions, weapons, basic material, complex machining, and assembly. As a result of these detailed analyses, the Department concluded that no extraordinary actions beyond prudent shutdown planning and execution were required. There are enough tanks available now to meet any perceived contingency, and there is enough time to reconstitute the tank industrial base if a global threat emerges. Therefore, tank production will cease as planned.

## Initiatives to Stimulate Efficiency and Competition

The Department has several initiatives underway to stimulate efficiency and competition and to minimize the needs for exceptions. Some examples are described below.

The Department is streamlining weapon systems maintenance operations by allowing military maintenance depots and private firms to compete for maintenance work. Historically, most weapon systems maintenance was performed within the services, after a period of transition during which the system developer performed maintenance. Since inception of the competitive program several years ago, our

primary goal has been to receive the best services at the best price. At the same time, we seek to preserve appropriate surge (or core) capability, while assuring a fair comparison of costs between the public and private sectors. This competition has encouraged all participants to become more efficient through consolidation of operations and streamlining of support costs. These improvements continue to be demonstrated with each round of depot maintenance competition.

In addition to working toward greater efficiency in the depots, force structure reductions have enabled the Department to return some overseas maintenance capabilities back to the United States. For example, depot maintenance work from Mainz Army Depot in Germany and Subic Bay in the Philippines will be performed in the United States. For Mainz Army Depot, about half of the workload will go to other Army depots in the United States and the other half will be opened for competition among defense depots and private industries.

As part of an effort to integrate production capabilities and technologies, the National Defense Manufacturing Technology (ManTech) Plan has been developed. It outlines the DoD ManTech efforts to apply manufacturing technology advances in a wide variety of specialized areas, like precision machining, composites fabrication, and electronics packaging. It also addresses specific service initiatives for improving unique manufacturing processes. This plan is serving as the framework for a more comprehensive Defense Manufacturing Strategy, which will consolidate DoD manufacturing process improvement initiatives.

In order to broaden its access to the national industrial base, the Department is shifting from military-unique products and processes to commercial counterparts wherever possible. To satisfy new materiel requirements, we first research the marketplace to identify commercial alternatives and, if necessary, perform trade-off analyses to avoid the development of new military-unique items. By using commercial items, we capitalize on economies of scale and achieve efficiencies in peacetime. We also gain access to a larger industrial base that becomes an important foundation for a capability to regenerate forces to meet an emerging major threat. Commercial capability enables our downsizing to proceed more coherently; for example, commercial engine production is the foundation for automobile, truck, and tank engine manufacturing. It is not necessary to specifically keep a tank engine industrial base in operation when efficient commercial processes exist.

## Conclusions

The Department of Defense will continue to emphasize the importance of the industrial base. Although total defense spending will decrease, the Department has an approach which capitalizes on our technological flexibility to assure that the industrial base is capable of meeting peacetime needs, while maintaining the ability to reconstitute larger forces faster than any potential enemy.

DoD policies emphasize the maintenance of design, production, and technological capabilities in special areas critical to future defense needs. These policies rely on a free market approach which, with limited exceptions, provides the basis for what we need.

The reduction in the force structure and the defense budget means that we cannot sustain programs or production capacity that we do not absolutely need. Sustaining them would divert scarce resources from the real muscle of defense -- trained and ready forces equipped with first-rate weapons. Unnecessary products and programs sap readiness and hinder our ability to pursue the technological advances that are the basis of the qualitative advantage of U.S. weapons.

# DEFENSE SCIENCE AND TECHNOLOGY STRATEGY

The dramatic collapse of the Soviet Union and the spread of democracy and freedom throughout the former Soviet Bloc has transformed the world, removing the old East-West confrontation. This change in the strategic environment gives the United States the opportunity to begin reducing the size of its armed forces while still retaining the military capability needed to protect its interests. But as Iraq's invasion of Kuwait shows, the end of the Cold War has not ended all threats to America's security. Of particular concern is the proliferation of highly sophisticated weapons which could be used in regional disputes and possibly against U.S. forces.

We have altered our military strategy and are reshaping our military force structure to focus on dealing with regional crises and conflicts -- the type of contingences we most expect in the years ahead. We have also revised our approach to acquisition to meet the demands of the new environment.

In the past, when faced with the Soviet Union's unprecedented buildup of modern military power, there was pressure to move new technology weapons quickly to production to stay ahead of Soviet modernization efforts. With the demise of the Soviet threat, we can proceed at more deliberate pace of modernization.

Nonetheless, we need to maintain a technological advantage over our adversaries. The Gulf War clearly showed the benefits in possessing superior weapons. To maintain our technological edge, Science and Technology (S&T) has been given a central role within the Department's acquisition process.

The new S&T strategy has three primary elements: sustaining and applying the dramatic advances in information technology, involving the user early and continuously, and demonstrating the technology extensively and realistically. This strategy will allow us to prepare for an uncertain and potentially dangerous future.

The S&T strategy is an integral part of the Department's acquisition strategy for meeting the weapon and equipment needs of the nation's armed forces.

## INFORMATION TECHNOLOGY EXPLOSION

The S&T strategy is being planned to promote and take advantage of the information technology explosion and to adapt and convert it into technologies that will revolutionize military operations. This explosion has been fueled by the exponential increase in the speed and capability of modern computers and associated microelectronics.

Together with the development of increasingly capable computer networks, these advantages are creating tremendous opportunities to design better and more affordable systems, to simplify the training of personnel, and to create a more effective command, control communications, and intelligence structure. The information revolution will also make it easier to employ distributed simulation systems, which links users located at different sites, and undertake exercises that involve combat-experienced personnel directly and intimately in the evaluation of new technologies.

## INVOLVEMENT OF WARFIGHTERS

A key element of the S&T strategy is the early and continuous involvement of the users of technology. The strategy places great importance on the feedback of concepts and doctrine from the warfighters to the developers of the technology and the systems. It also stresses the need to "feed-forward" new technology and systems from the developers to the operators.

These feedback and feed-forward loops will take place on a much expanded and integrated set of instrumented training ranges and electronic battlefields. "Synthetic environments" are being networked throughout the scientific and development communities to bring scientists, engineers, developers, manufacturers, and warfighters together to address and solve their most pressing problems.

## ADVANCED TECHNOLOGY DEMONSTRATIONS

A central tenet of the S&T strategy is that technology will be focussed toward specific capabilities that can be proven with an Advanced Technology Demonstration (ATD). There are generally two types of ATDs: those focused on new system and subsystem concepts and those focused on "enabling" technologies. Demonstrations

of capability, coupled with simulations and exercises, will help to ensure that the technology is ready and affordable, manufacturing processes are available, and operating concepts are understood before committing to a formal acquisition program.

Technology demonstrations are not new. The Have Blue aircraft, for example, showed that stealth was technically feasible. Assault Breaker demonstrated the technology that went into both the Joint Surveillance Target Attack System radar and the Joint Tactical Missile System. Another program demonstrated the ability to produce low-cost microwave integrated circuits.

What is new is the scope and depth of the technology demonstrations, the increased importance of their role in the acquisition process, and the emphasis on user involvement to permit an early and meaningful evaluation of overall military capability. ATDs will be designed to permit an informed decision on the feasibility, affordability, and producibility of the technology and on its compatibility with the operational concepts and structure envisioned for the armed forces.

## PROVIDING FOCUS - SEVEN S&T THRUSTS

To provide the focus for the S&T program, seven broad areas of capability have been defined. These Seven Thrusts represent our current assessment of the areas on which the S&T program should be focussed to address the users' most pressing military and operational needs. While there are goals and activities in the S&T program which fall outside of these thrusts, it is crucial to the maintenance of our technological superiority that our investments and energies be focused on those efforts which are most important to -- which show the greatest promise for improving -- future military capabilities. The Seven Thrusts are:

1. **Global Surveillance and Communications.** The ability to project power requires a global surveillance and communications capability that can focus on a trouble spot, surge in capacity, and be responsive to the needs of the commander.

2. **Precision Strike.** The goals of increasing the effectiveness of weapons and reducing casualties, while using fewer weapons platforms, demand that we locate high-value, time-sensitive fixed and mobile targets and destroy them with a high degree of confidence.

3. **Air Superiority and Defense.** The need to defend deployed military forces from ballistic and cruise missiles and to maintain our current decisive capabilities in air combat, interdiction, and close air support requires a focussed effort in missile defense and air superiority.

4. **Sea Control and Undersea Superiority.** The need to maintain an overseas presence, conduct forcible entry and naval interdiction operations, and operate in littoral zones requires superiority in sea control and undersea warfare.

5. **Advanced Land Combat.** The ability to rapidly deploy our ground forces to a region, exercise a high degree of tactical mobility, and neutralize the enemy quickly and with minimal casualties in the presence of a heavy armored threat and smart weaponry requires highly capable and survivable land combat systems.

6. **Synthetic Environments.** A broad range of information and human interaction technologies must be developed to synthesize present and future battlefields, identify critical problem areas, and speed the development of cost-effective solutions. Synthetic battlefields will involve a mix of real and computer-simulated equipment. Integrated teams of users, developers, and/or testers will be able to interact effectively, even from widely dispersed locations, by linking them electronically. Synthetic environments will prepare our leaders and forces of war.

7. **Technology for Affordability.** Technologies that reduce unit and life cycle costs are essential to achieving significant performance and affordability improvements. Advances are particularly needed in technologies to support integrated product and process design, flexible manufacturing systems that separate cost from volume, enterprise-wide information systems that improve program control and reduce overhead costs, and integrated software engineering environments.

Within each Thrust Area specific ATDs are being structured to meet the goals established for that thrust. Detailed roadmaps to guide their progress are also being developed. The technologies that are exploited in these ATDs are derived from exploratory development programs, which in turn build on new knowledge derived from the basic research programs. The critical challenge is to tie these programs together in an efficient and effective way.

The focused thrusts do not constitute a complete description of the entire DoD S&T program. In planning our overall S&T investment, a critical balance will be maintained between preserving the core of broad, sustaining programs, and taking discrete initiatives, such as the thrusts, focussed on laying the technical foundations for acquiring significant warfighting capabilities. The Director of Defense Research and Engineering must ensure that a balanced portfolio of investments is maintained as the Department pursues these specific initiatives.

CONCLUSION:

The goal of the Science and Technology program is to provide for the availability and integration of advanced technology to meet military needs. The S&T strategy emphasizes meeting the needs of the fighting forces while at the same time making available new technologies to meet pressing operational problems. The S&T strategy is structured to focus the S&T program in order to maintain a position of technological superiority that is essential for the success of America's military forces.

4.

## Science and Technology Management and Oversight

The Director, Defense Research and Engineering (DDR&E) is responsible to the Under Secretary of Defense (Acquisition) (USDA(A)) for the science and technology (S&T) program, which includes research, exploratory development, and advanced technology development efforts within DoD. The DDR&E has formulated a new strategy that focuses the S&T program on the most pressing needs of military users and system developers. The roots of our technological strength and creativity lie in our research and exploratory development efforts, which are carried out in defense laboratories, colleges and universities, and industry. The fruits of these efforts will transition to advanced technology development, where military utility, affordability, producibility, and other factors will be evaluated before selected technologies proceed further into the more formal systems acquisition process.

A Defense Technology Board (DTB) has been created to assist the DDR&E in all S&T matters, including formulating annual S&T strategy and guidance and reviewing components' plans and programs. Chaired by the DDR&E, the DTB consists of the Service Acquisition Executives (SAEs) and representatives of the USD(A), pertinent Defense Agencies, the Joint Chiefs of Staff, the Assistant Secretary of Defense for C3I, the Assistant Secretary of Defense for Production and Logistics, and the Assistant Secretary of Defense for Program Analysis and Evaluation.

The purpose of this paper is to document the procedures that will be used by the DDR&E in planning and executing the DoD Science and Technology program. The procedures include those for managing each phase of the S&T program and transitioning between phases, beginning with basic research and culminating in Advanced Technology Demonstrations (ATDs).

### RESEARCH

The research program is structured to explore the fundamentals of science and engineering with a goal of expanding our understanding and validating scientific theory. The research program supports cutting-edge scientific and technological development. The DDR&E will provide guidance on the structure of the overall research program prior to the preparation of the Program Objective Memoranda

(POM). The guidance will ensure adequate emphasis on defense requirements and research necessary to support S&T thrusts while maintaining balance on innovative sciences and those efforts necessary to preclude technological surprise. DDR&E will review the Service and Defense Agency S&T POM submissions to ensure compliance and to preclude unnecessary duplication. SAEs will be responsible for management and execution of the research program approved by DDR&E during the Program Planning and Budget System (PPBS) reviews. DDR&E will evaluate S&T program execution coincident with the POM and budget submissions to recommend changes, refocus efforts, and consider candidates for transition to the next phase. DDR&E recommendations will be documented in a Science and Technology Issue Paper for the Defense Planning and Resource Board (DPRB).

## EXPLORATORY DEVELOPMENT

The primary goal of exploratory development is to transition promising research efforts into technologies that could meet warfighting needs. The DDR&E will evaluate accomplishments in the research program as candidates for transitioning to exploratory development. Among the factors that DDR&E will consider are technical maturity as demonstrated in the laboratory, warfighting potential as evaluated by the military chiefs of staff, and affordability. Prior to preparation of the POM, the DDR&E will establish criteria that will be used to evaluate candidate exploratory development efforts. The DDR&E may delegate approval authority for initiation of exploratory development efforts to the Deputy DDR&E(S&T) or the appropriate SAE/Defense Agency Director. Thresholds and other criteria that govern such delegations will be developed and documented by DDR&E prior to submittal of the Service/Agency budgets. DDR&E recommendations will be documented in a Science and Technology Issue Paper for the DPRB.

The DDR&E will monitor the progress of the exploratory development efforts to ensure compliance with guidance and direction and to identify promising candidates for transition to advanced technology development.

## ADVANCED TECHNOLOGY DEVELOPMENT

Advanced technology development efforts are structured to develop and integrate hardware for field experiments and tests; this is the demonstration phase of

S&T. Candidates include those that have successfully transitioned from research and exploratory development and those which may have evolved from independent industry or other efforts. The advanced technology development program provides funding to develop and fabricate hardware and software to evaluate performance, military utility, affordability and producibility issues. The DDR&E S&T strategy focuses these efforts into thrust areas that are directly related to future warfighting requirements. The thrust areas are:

- Global Surveillance and Communications
- Precision Strike
- Air Superiority and Defense
- Sea Control and Undersea Superiority
- Advanced Land Combat
- Synthetic Environments
- Technology for Affordability

The emphasis of the advanced technology development effort will be on Advanced Technology Demonstrations (ATDs). While the bulk of the funding will be on ATDs, there will be projects that do not directly fit within the current thrust areas. These activities will be approved by DDR&E as part of the POM review and executed by the Services/Defense Agencies.

ATDs are separated into three categories: those that are projected to require less than $115 million in total funding and can be approved by the SAE/Agency Director; those requiring more than $115 million but less than $300 million and must be approved by DDR&E; and those above the $300 million threshold which must be approved by USD(A). The USD(A) or DDR&E may also designate special interest ATDs that may fall below normal thresholds but still require higher level approval. ATDs will be continually tracked and evaluated from the point at which they are proposed through completion; the level of reviewing authority will depend on funding level or designation.

An ATD will be proposed by a Service or Agency and may offer enhanced performance capability; more affordable acquisition or logistics support; or improved operability, such as ease of training. ATDs include projects that demonstrate the potential military utility of technology concepts, as well as more advanced transition projects that emphasize technical integration and assessment in a realistic environment. The proponent will define the objective of the proposed ATD and will develop a demonstration strategy, schedule, and exit criteria. Wherever practical, the plan will rely on modeling and simulation for both risk reduction and evaluation. The proponent should identify known and potential customers, including systems developers, and operators. Potential use by more than one service (joinmess) will be an inherent factor in evaluating an ATD.

The DDR&E has established a thrust leader for each of the S&T thrusts identified in the S&T strategy. The thrust leaders, working with representatives from executing organizations, develop the programs necessary to achieve the goals established in the S&T strategy. They also identify technologies needed to attain those goals.

Thrust leaders will evaluate and prioritize proposed ATDs in the context of the overall thrust area. Criteria such as potential benefits, technical maturity, joinmess, affordability and operability are considered in the evaluation process. The DDR&E(S&T)'s senior technologists will evaluate and provide comments to the thrust leader on technical issues.

All proposed ATDs will be evaluated in the context of the S&T strategy and the DoD budget. Other issues that will be considered and documented are benefit-to-cost factors, evaluation and exit criteria (performance, affordability, and operability thresholds for moving out of this phase), and funding. The SAE/Agency Director will document the disposition of ATDs falling in the less than $115 million category, the rationale for the action taken, and other factors, including ATD evaluation. The documentation will be forwarded to the executing activity and DDR&E. ATDs that are estimated to cost between $115 and $300 million, or those identified as of special interest by the USD(A) or the DDR&E, will be documented in a Science and Technology Issue Paper for the Defense Planning and Resource Board, which also identifies any other factors or issues that must be addressed. If the ATD is above the $300 million funding threshold, the documentation is

forwarded along with a recommended action to USD(A). The DTB will assist the DDR&E in the proposal and progress reviews.

## PROGRESS REVIEWS

The DDR&E reviews the progress of ATDs in accordance with the schedule and evaluation criteria established at the initiation of the ATD. If progress is satisfactory, the lead agency continues to execute the ATD as planned. In the case of an adverse review, a change in the S&T strategy, or a proposed change in thrust goals, the DDR&E initiates appropriate action. As ATDs mature, and the progress reviews dictate, thrust leaders coordinate the future plans for each project with officials responsible for management of system acquisition activities. This may involve the services, for component-managed system acquisition, or the Defense Acquisition Board (DAB).

At the exit milestone, the DDR&E recommends one of three actions to the USD(A): (1) submit the technology to the milestone decision authority for possible transition to the systems acquisition process (including upgrades to existing systems); (2) expand the goals and continue to develop and demonstrate the technology; or (3) "file" the technology for future reconsideration.

## PROGRAMMING AND BUDGETING FOR SCIENCE AND TECHNOLOGY

The DDR&E has been authorized to provide direction to the Secretaries of the Military Departments and Heads of other DoD Components, when necessary, on all activities supported by S&T funds. The DDR&E's directions on S&T plans, programs, and budgets are normally carried out through the PPBS process.

**Planning and Guidance:** The Defense Planning Guidance (DPG) provides guidance for DoD Components' development of POMs. The DPG from the Secretary of Defense incorporates the S&T strategy's goals and may contain additional guidance on S&T funding levels. As necessary, the DDR&E issues more detailed guidance for use by DoD Components in preparing the S&T portions of their POMs.

**Program Objective Memoranda:** The Components prepare their S&T POMs in accordance with the guidance and the POM Preparation Instructions. The DTB assists in the DDR&E review of the Components' POMs to ensure that they respond

to guidance, are consistent with the S&T strategy, and are funded at their "most likely" cost. This review is structured to preclude unnecessary duplication and to ensure that the programs' size and direction supports the established goals of the S&T program.

The DDR&E reviews the S&T POM submissions and prepares an S&T issue paper to make any necessary adjustments. With the approval of the USD(A), the DDR&E, a principal of the Defense Planning and Resource Board (DPRB), presents the issue to the DPRB for consideration. The DPRB's decision is incorporated in the Program Decision Memoranda (PDMs), which serve as direction to DoD Components for preparation of their Budget Estimate Submissions (BES).

**Budget Estimate Submission:** The DDR&E reviews Components' budgets. The process operates similarly to the process described above for the POM. For the budget review, the objective is to ensure that budgets are responsive to the PDMs.

The budget review focuses on the ATDs. The DDR&E ensures that proposed resources are consistent with ATDs' execution plans and protects the integrity of programs involving more than one service. Changes in Components' ATD programs that have occurred since the POM submissions and have not been included in the PDMs are also evaluated. Where adjustments are needed, the DDR&E recommends Program Budget Decisions (PBDs), through the USD(A) and Comptroller, to the Deputy Secretary for approval.

CONCLUSION:

This decision making process incorporates the best attributes of corporate planning and the benefits of decentralized execution. This combination should lead to an active, responsive and focused Science and Technology Program that helps DoD make the most efficient and effective use of its limited resources. This is essential if we are to leave a technology-rich legacy for the warfighters of the early 21st century, much like the legacy that decision-makers of the 1960s and 1970s left to coalition forces in Operation Desert Storm.